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IMAGE PROCESSING BASED COLOUR POINTER TO DRIVE WHEELCHAIR USING OPENCV

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ABSTRACT

This paper may be helpful to handicapped people can live with ease life. The wheelchair can be operated with the help of any moving body part having red colour pointer. It makes the handicapped people as a independent. System comprises of integration of Red colour pointer operation using digital image processing and embedded technology. Disability affects hundreds of millions of families in developing countries. According to the World Health Organization (WHO), Currently around 10 per cent of the total world's population, or roughly 650 million people, live with a disability. In indiadisabled population has increased by 22.4% between 2001 and 2011. The number of disabled, which was 2.19 crore in 2001, rose in 2011 to 2.68 crore—1.5 crore males and 1.18 crore females. This indicates that the most common disability is motor, followed by blindness, deafness, intellectual and language. Wheelchairs is necessary for disable persons to move from one place to other i.e indoor or outdoor navigation.

KEYWORDS: Digital Image Processing, Embedded Technology, Red Colour Pointer Operated Wheelchair

INTRODUCTION

Wheel chair are used by the disable persons who cannot walk due to illness, injury, damage of brain or spinal cord. The traditional wheelchair consist wheels which can either pushed by individual or other person or propelled by physical force or electronically.

The current wheelchairs are mostly button driven, and cannot fully meet the need of the disabled and elder people. Whose autonomies are seriously affected by decline in their motor function and cognitive performance this is the survey done by WHO in 2002. To drive wheelchair various interface have been developed for the disabled with the operations of hand guesture, head movement and tongue motion, speech, push-button, eye tracking but the proposed paper represent the image processing based red colour pointer operated wheelchair. Use of this proposed technology is very much user friendly and requires very less muscle movement form the user. An IR obstacle detection unit can be used which is fixed to the wheelchair to avoid possible collision. In such a way proposed technology shows embedded system and digital image processing together work for movement of wheelchair.

PROBLEM STATEMENT

Tetraplegia is a paralysis results in the partial or total loss of use of their limb. Tetraplegia is caused by damage of brain or spinal cord. Praplegia is similar but not affect the arms. So the physically challenged people are not comfortable to move from one place to other. It makes them dependable on others. They also find difficulty to control the wheelchair

manually. Thus there is a need for an improved method of navigation for the wheelchair. One such method proposed here is the colour pointer based navigation in which simple colour pointer forms the input to the system which is processed, recognized and used for navigating the wheelchair. With the help of this method, the physically challenged people will find it comfortable for indoor navigation and does not need an external aid.

PROPOSED METHODOLOGY

Block Diagram

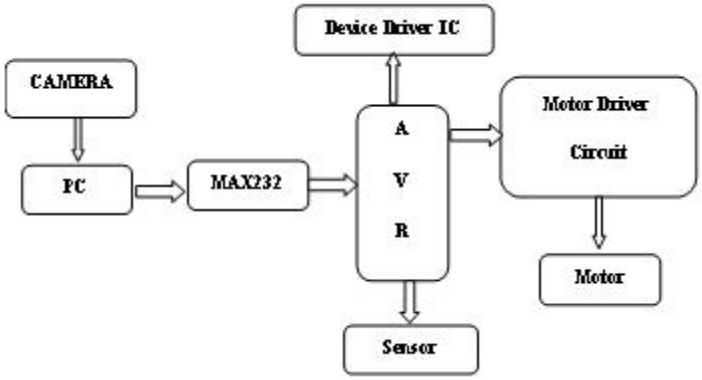


Figure 1: Block Diagram of Red Colour Pointer Controlled Wheelchair

Description

Camera

Camera or web camera can be used to capture the image.We can use webcamera for capturing image input from colour pointer by user. According to input image we can select the operatrion on wheelchair i.e Moving forward, reverse, left, right & stop.

PC

The captured image of colour pointer is send to the PC. The PC is processed the capture imageand find the coordinates of colour pointer & sent it to the microcontroller and the motor is drive accordingly.

AVR: Advance Virtual Risc

The AVR is 8-bitHarvard architecture microcontroller. The AVR or 8051 microcontroller can be used to accept serial communication data with buad rate 9600. It has inbuilt RAM & ROM.

MAX 232

It is a logic converter which is used to convert CMOS logic to TTL logic. It is used for serial communication between PC & microcontroller.

Motors

Motors of 12V DC, 60 rpm can be used for small prototype model. It also requires motor driver IC or circuit.

Table1: Operation of Motor

Operation	A	B
STOP	LOW	LOW
CLOCKWISE	HIGH	LOW
ANTICLOCKWISE	LOW	HIGH
STOP	HIGH	HIGH

Algorithm for Movement of Wheelchair

- Start
- Capture the image
- Adjust the Hue, Saturation, Value from control bar
- Convert RGB to HSV
- HSV Image Thresholding
- Morphological Opening & Closing
- Red Colour Pointer Detection
- Colour Pointer recognition
- Stop

Flow Chart

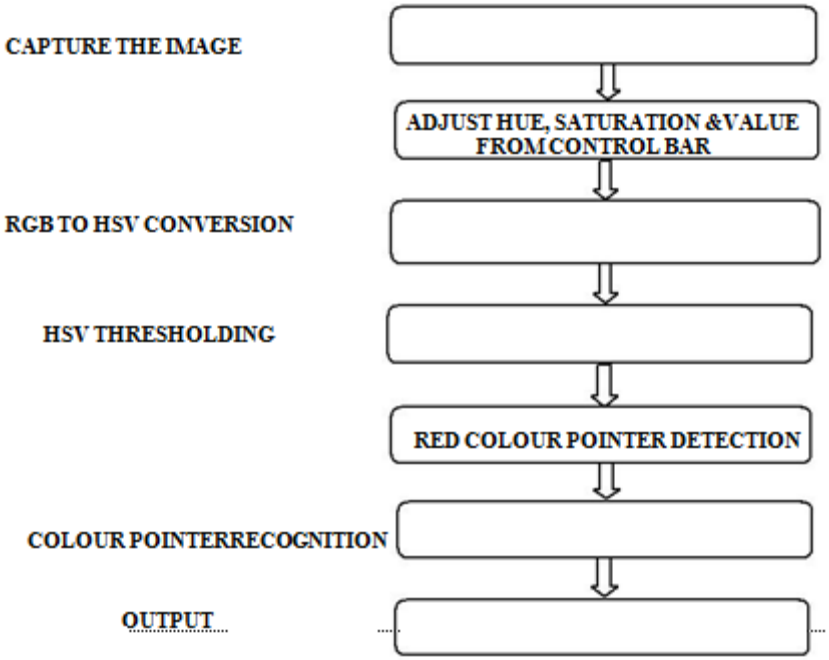


Figure 2: Flowchart for Red Colour Pointer Operated Wheelchair

Flow Chart Description

Capture the Image

Camera or web camera can be used to capture the image. The captured image is further process to decide which type of input image.

According to input image we can select the operatrion on wheelchair i.e Moving forward, reverse, left, right & stop.

Figure 3: An Image Capture for Forward Operation

Adjust the Hue, Saturation, and Value from Control Bar

Figure 4: An Adjust the Hue, Saturation, and Value from Control Bar

That the red object has HUE, SATURATION and VALUE in between 170-180, 160-255, 60-255 respectively. Here the HUE is unique for that specific color distribution of that object. But SATURATION and VALUE may be vary according to the lighting condition of that environment.

Hue values of basic colors

- Orange 0-22
- Yellow 22- 38
- Green 38-75
- Blue 75-130
- Violet 130-160
- Red 160-179

These are approximate values. You have to find the exact range of HUE values according to the color of the object. I found that the range of 170-179 is perfect for the range of hue values of my object. The SATURATION and VALUE is depend on the lighting condition of the environment as well as the surface of the object.

Convert RGB to HSV

There are two main colour spaces are RGB and HSV. RGB colour space represent the amount of red, green & blue colour present.

HSV colour space represent the amount of Hue, Saturation & Value present.

'H' means Hue, represents the dominant colour or pure colour or colour type. It ranges from 0-255.

'S' means Saturation represents Presence of white colour or vibrancy of the colour. The lower the saturation value represents the grayer colour is present.

'V' means Value represents brightness of the colour. It ranges from 0-255, with 0 - completely dark & 1- fully bright

Advantages of HSV over RGB

- Strong model than RGB because it offers a more intuitive representation of the relationship between colors. .
- HSV select more specific color.

HSV Thresholding

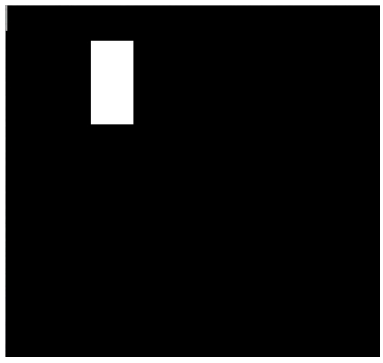


Figure 5: RGB images of Forward Operation Figure 6: Forward Operation image with Thresholding

Thresholding means convert greyscale image into binary image which having two colour i.e. black & white. After thresholding the image, you'll see small white isolated objects here and there. It may be because of noises in the image or the actual small objects which have the same color as our main object. These unnecessary small white patches can be eliminated by applying morphological opening. Morphological opening can be achieved by a erosion, followed by the dilation with the same structuring element. Thresholded image may also have small white holes in the main objects here and there. It may be because of noises in the image. These unnecessary small holes in the main object can be eliminated by applying morphological closing. Morphological closing can be achieved by a dilation, followed by the erosion with the same structuring element.

Colour Pointer Detection and Recognition:

The Colour Pointer Detection and Recognition is the important part & can be done with the following algorithm.

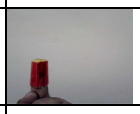
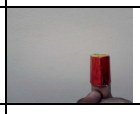
Algorithm

- Find moments to calculate the position of colour pointer.

- Find the exact position (x, y coordinates) of colour pointer.
- Divide the given live frame into four quadrant.
- If x, y coordinates lies into I quadrant then move forward.
- If x, y coordinates lies into II quadrant then move Reversed
- If x, y coordinates lies into III quadrant then move Left.
- If x, y coordinates lies into IV quadrant then move Right.
- Else stop

RESULTS

Table 2: Result of Wheelchair Movement

Sr. no.	Colour Pointer Movement	Input Image	Motor Movement (A)	Motor Movement (B)	% Accuracy
1	Forward		Forward	Forward	100
2	Reverse		Reverse	Reverse	100
3	Left		Forward	Reverse	100
4	Right		Reverse	Forward	100
5	Stop		No Operation	No Operation	100

CONCLUSIONS

- The handicapped people can live with ease life.
- The wheelchair can be operated with the help of any moving body part having colour pointer.
- The microcontroller with baud rate 9600 is used for faster serial communication &interfacing to wheelchair.
- This technology has been applied in modern gaming consoles to create interactive games where a person's motions are tracked and interpreted as commands.

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